thus be brought about, we may examine a figure which shows the composite elevations and depressions that are represented by harmonics of the first and second degrees, and, separately, those which are represented by harmonics of the third degree. In Fig. 15 the composite elevations of the first and second degrees are shaded vertically, and the elevations of the third degree are shaded horizontally. The deep parts of the Atlantic that border the coasts everywhere from Brazil to Ashanti are regions in which a depression represented by the third harmonic is superposed upon an elevation represented by the other two harmonics, and the same is true of the deep parts of the Indian Ocean which border the shores of Africa and Asia from Madagascar to Burmah. The deep parts of the Pacific that border the western coast of America from Alaska to Chi are regions in which an elevation represented by the third harmonic is superposed upon a depression represented by the other harmonics. These observations suggest that in the greater part of the Atlantic and the northern and western parts of the Indian Ocean the direction of sæcular change may have been that of an advance of the ocean to encroach upon the continental region, while in the Pacific Ocean on the American side the direction of sæcular change may have been that of a retreat of the ocean, permitting an extension of the continental region. This difference would lead us to expect different types of coast in the two regions, and such a difference has been observed. Whereas in the Atlantic region, with few exceptions, the coast cuts across the directions of the mountain chains, in the Pacific region on the American side the coast generally corresponds in direction with the neighbouring mountain chains of the continent. The deep parts of the Pacific which are nearest to the Asiatic coast from Kamchatka to Siam are regions where a moderate depression represented by the third harmonic is superposed upon a moderate elevation represented by the other harmonics. These shores of the Pacific are distinguished by the wide margin which separates the deep ocean from the coast of the continent. It might perhaps be desirable to recognise in this region a type of coast differing from the two main types associated with the Atlantic and the American side of the Pacific. The analysis does not represent South Africa or the southern parts of South America sufficiently well to warrant us in expecting these regions to exhibit one type rather than the other; but the way in which Australia is represented, as an elevation of the third degree superposed upon a depression of the first, suggests that the coasts of Australia, and especially the eastern coast where the elevation in question is greater, should be of the same type as the American shores of the Pacific; and it is the fact that the mountain chains of Queensland and New South Wales run parallel to the neighbouring coasts. There seems therefore to be much evidence to support the view that the direction of sæcular change has been that of diminishing the prominence of the inequalities of the first and second degrees in comparison with those of the third degree. The process by which such changes would be brought about would be of the nature of relief of strain, expressing itself in occasional fractures of no very great magnitude; and such fractures would be manifested at the surface as earthquakes. Seismic and volcanic activities constitute the mechanism of the process of change. These activities are spasmodic and irregular, but the effect of them is cumulative. For this reason they tend in the course of ages to transform the shape of the earth from one definite type to another. The diminishing speed of the earth's rotation is another cause of change which appears to produce an alternating rather than a cumulative effect. On the one hand it tends to diminish that tendency, which we noted above, to draw the waters of the ocean towards equatorial regions; on the other hand it must result in an actual reduction of the equatorial protuberance of the earth's figure. This reduction can only be effected by seismic activity expressed by subsidences in equatorial regions. The effect which would in this way be produced in the distribution of continent and ocean would appear to be that there would be long periods in which the ocean would tend to advance towards the Arctic and Antarctic regions, interrupted by shorter periods in which it would tend to retreat towards the neighbourhood of the equator.

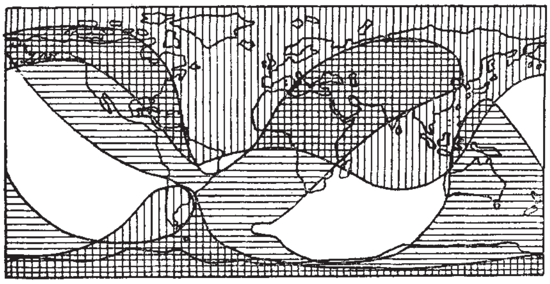


Fig. 15.

The theory which I have tried to explain is a tentative one, and further investigation may prove it to be untenable; but it is to its credit that, besides tracing to dynamical causes the existing distribution of continent and ocean, it offers an explanation of the difference between the Atlantic and Pacific types of coast, it gives indications of a possible account of those alternations of sea and land which first led to the study of geology, and it suggests an origin for Charles Darwin's unknown force the operation of which is slow and intermittent, but irresistible.

NOTES.

NEXT year's meeting of the British Medical Association will be held at Sheffield under the presidency of Mr. Simeon Snell. This year's meeting is at present in progress at Exeter. On Tuesday last the president, Dr. Henry Davy, delivered his address, taking as his subject "Science in its Application to National Health."

THE *Nimrod*, in which Mr. E. H. Shackleton's expedition will proceed to the Antarctic regions, sailed from the Thames on July 30 with Lieut. Rupert England in command. Lord Kelvin has presented to the expedition a standard compass and sounding instruments. The Admiralty is lending a compass, chronometers, charts, and sounding apparatus, as well as three Lloyd-Creak Dip instruments for the landing party. Watches are being supplied by the Royal Geographical Society, and, in addition, the vessel will be equipped with a liquid steering compass and a special pole compass. The members of the expedition on board the *Nimrod* are Mr. James Murray, the biologist of the expedition; Mr. W. A. Michell, surgeon and zoologist; and Mr. A. F. Mackay, the junior surgeon of the landing party, who will also engage in zoological work. At Lyttelton, New Zealand, the remaining members of the expedition will join the ship. These include, besides Mr. Shackleton, Mr. E. Marshall, senior surgeon of the shore party and cartographer of the expedition; Lieut. Adams, R.N.R., who will be in charge of the meteorological work; and Sir Philip Brocklehurst, for survey work and field geology. Dr. David, professor of geology in Sydney University, has arranged to accompany the expedition south to King Edward VII. Land.

THE weather still continues very cool for the time of year, but on the whole the conditions lately have been somewhat dry. At Greenwich there has been no year since 1888 with so few warm days in July, and the thermometer has not once touched 80°. The total rainfall for the month is less than an inch, whilst the average for the past sixty years in July is 2·40 inches. The aggregate rainfall for the first eight weeks of summer, to July 27, is less than the average in the north-east, east, and south of England, and in the Channel Islands, but in every other district of the United Kingdom it is in excess of the normal. The greatest excess for the summer is 2·42 inches, in the north-west of England, whilst the greatest deficiency is 1·17 inches, in the east of England, the measurements being respectively 7·21 inches and 2·88 inches, and the rainy days respectively forty-one and twenty-six. Both the temperature and the sunshine for the summer have, so far, been below the average.

THE experiments which have been in progress in the Congo State for some time past in training the African elephant for domestic work are progressing satisfactorily. During the first three months of the present year, eight young elephants were captured, bringing the stud up to a total of thirty. At first the wild elephants suffer in health on confinement, but this depression soon passes off. Similar experiments are being made in the British territory of Uganda, but so far the results there are uncertain.

As illustrating further the want of sympathy with scientific research shown by the Indian administrative authorities, to which Prof. Ronald Ross, F.R.S., directed attention in an exhaustive article contributed to our issue of June 13, an Indian correspondent writes concerning the rules of the India Office regulating the supply of apparatus to Government colleges. According to these rules, our correspondent states, any piece of apparatus of European manufacture—costing more than 3*l.* 7*s.*—can only be obtained by requisitioning through the Secretary of State. Requisitions are prepared once a year, and, as a rule, eighteen months elapse between writing a demand and the arrival of the apparatus. It is nearly impossible to foresee everything that may be required during the prosecution of a research, and it happens sometimes that a man of science must wait three years for necessary material. The reasonable contention is made that professors in India should be permitted to spend their laboratory funds themselves and to deal with manufacturers direct. It is surely not taking too much for granted to suppose that men in responsible positions, who presumably have been selected for their posts with great care, may be trusted to administer their funds honestly and to the best advantage of the institutions with which they are connected. The system of having to requisition scientific instruments and materials a year or more in advance is not confined to India, and it is both discouraging to scientific work and wasteful in practice.

IT is interesting to find that the traditional date assigned to one of the great cycles of national legend is confirmed by independent evidence, and this in the case of the oldest existing literature of any of the peoples who dwelt to the north of the Alps. According to the native annals of Ireland, the Celtic heroes, Conchobar and Cuchulainn, flourished about the beginning of the Christian era, and though some authorities have supposed Cuchulainn to be a degraded Celtic god, there can be no reasonable doubt that he and his uncle lived and fought on earth. This traditional date is supported by the fact, already well recognised by scholars, that, though the poems were at a later date modified by their ecclesiastical transcribers, their spirit is essentially pagan. Prof. Ridgeway, in a paper recently submitted to the British Academy, has approached the problem from the point of view of the archæologist. From an elaborate investigation of the ethnology of this heroic race, their methods of fighting, their use of chariots—unknown to the later Ossianic poems—their arms and armour, and their dress and jewellery, as described in the Cuchulainn Epic, he is able by a comparison of remains of the La Tène period discovered in Ireland to decide that this cycle of culture is here represented; that, as is asserted in the Irish traditions, a tall, fair-haired, grey-eyed race of Celts, like those of Britain and the Continent, invaded Ireland in the centuries immediately before the birth of Christ, and that the poems themselves took shape when the La Tène form of culture was still flourishing in the country, which can hardly have been much later than 100 A.D. The evidence of tradition and archæology thus happily combines to establish the date of this important Saga literature.

ACCORDING to the report of the Northumberland Sea-fisheries Committee for the past year, the prospects of the fisheries under its supervision are very satisfactory, the marked falling-off in the products of trawling, which has been so noticeable for many years, having at length given place to a distinct upward tendency. It was discovered some time ago that an extensive migration from the south of female crabs takes place during winter, and it is now ascertained that a similar state of affairs exists in the case of flounders, which travel when fully adult into Scotch waters. Means for extending the mussel-beds of the district have been carefully sought, but at present with no great success. The main reasons for the unsatisfactory state of the mussel-supply appear to be the crowded condition of some of the beds, the action of storms on others, and the destruction caused by whelks and starfishes.

JUDGING from the report for 1906, the Zoological Gardens at Giza, near Cairo, enjoy great popularity among native Egyptians, the number of visitors showing an increase of twenty-five per cent. on the previous year, which was itself a record season. At the close of last year the gardens contained a remarkably fine collection of African big game animals, inclusive of six Sudani elephants, nine beisa oryx, three addax, and three kudu.

THE skeleton of a wonderful new horned rodent, *Epigaulus hatcheri*, from the Miocene of Kansas, is described by Mr. J. W. Gidley in the Proceedings of the U.S. National Museum, No. 1554 (pp. 627–636). The total length of the mounted skeleton in a straight line is about 14 inches. From the allied Ceratogaulus, the genus differs by the larger and more backwardly directed horns, the reduced molars, and larger premolars. Although presenting some resemblances to the beavers and squirrels, it appears to be most nearly related to the sewellels (Haplodontidæ). The paper concludes with speculations as to what possible use horns can be to a burrowing animal.

THE porcupines of the Malay Peninsula and Archipelago form the subject of a paper by Mr. M. W. Lyon in the Proceedings of the U.S. National Museum, No. 1552 (vol. xxxii., pp. 575–594), in which the generic grouping is revised and several new forms are described. For the large Malay and Java porcupines, commonly known as *Hystrix brachyura* and *H. javanica*, F. Cuvier's genus Acanthion is reinstated. These porcupines differ from the typical Hystrix by the absence of a nuchal crest, the shorter quills, and much shorter nasal bones in the skull, which extend backwards only so far as the line of the lachrymals, instead of to the hind root of the zygomatic arch. A new species from Sumatra is made the type of a separate genus, as *Thecurus sumatrae*, differing from Acanthion by the smaller capsule-like extremities of the tail-bristles, often closed at the end, and the smaller quills, which are replaced on the lower part of the rump by grooved spines like those on the back. The remaining species are referred, as before, to the genera Atherura (or Atherurus) and Trichys.

FROM Prof. H. F. Osborn we have received copies of a number of papers published in the Bulletin of the American Museum of Natural History, *Science*, &c., from which the following are selected for notice. In vol. xxii., art. 13, of the first-named serial is described the milk-dentition of the hyracoid from the Egyptian Eocene known as Saghatherium, the teeth at that age serving to confirm previous conclusions as to the systematic position of the genus. A restoration of the skeleton and external form of the remarkable Permian reptile Naosaurus forms the subject of vol. xxiii., art. 14. The enormous neural spines of the dorsal vertebræ, armed with transverse spikes, are considered to have supported a sail-like expansion of skin, but no reference is made to the probable object of this structure; the creature measured about 8½ feet in length. A magnificent skeleton of the Columbian mammoth (*Elephas columbi*), discovered in Indiana in 1903, and now mounted in the American Museum of Natural History, is described in art. 12; the tusks are remarkable for their great curvature and the crossing of the tips. The extinct mammals of Patagonia, and American exploration in the vertebrate beds of the Fayum Eocene, form the subjects of two of Prof. Osborn's contributions to *Science*.

IN referring to a scientific expedition sent out by the University of Colorado to study the natural history of the north-eastern part of the State, it is mentioned that, owing to the diversity of climatic conditions, the flora of Colorado is only exceeded in numbers by the flora of the State of California, and possibly of Florida. The object of the expedition was to collect plants, birds, and fossils. Leguminous plants, notably *Psoralea tenuiflora* and species of Astragalus, were prolific in the dry localities. Varieties of Populus known as cotton wood were abundant along the streams. Details appear in vol. iv., No. 3, of the University of Colorado Studies, where Mr. F. Ramaley contributes a second article on the silva of Colorado, treating of the species of Populus.

C. E. Jones

AN official notice which has been issued by the Inspector-General of Forests in India, intimating that the series of Forest Bulletins initiated in 1905 will be superseded by two publications to be known as the Indian Forest Records and Indian Forest Memoirs, furnishes another proof of the recognition by the Government of India of the importance of the department. Similarly to the Records and Memoirs of the Geological Survey of India, the former, that will be issued as material accumulates, will be devoted to short articles, notes, and preliminary announcements; the latter will contain memoirs or monographs, and will also appear irregularly as occasion arises.

do

THE report for 1906 of the Director of Agriculture in the Federated Malay States has been received. In connection with rice cultivation, experiments have been instituted to test the value of rotation crops. The position of the rubber industry is reviewed, and the opinion is expressed in favour of pushing the manufacture of block rubber, since it approximates more nearly to the smoke-dried Brazilian product. On the subject of soils and the expense incurred by weeding, Mr. Carruthers recommends the cultivation of a suitable leguminous crop, such as *Mimosa rudica*, the sensitive plant, on rubber lands, that would not only increase the nitrogen in the soil, but would also tend to conserve the surface.

do

DR. J. C. WILLIS contributes a paper to the Annals of the Royal Botanic Gardens, Peradeniya (vol. iv., part i.), on the occurrence and origin of certain endemic plants on Mt. Ritigala in Ceylon and elsewhere, providing in his opinion strong evidence against the theory of the origin of species by natural selection of infinitesimal variations. Comparing a number of allied species, such as *Coleus elongatus*, an endemic on Mt. Ritigala, with *Coleus barbatus*, a plant widely spread through Ceylon and S. India, Dr. Willis controverts the view that the specific characters of the endemic have developed as adaptations by means of infinitesimal variations, and prefers the mutation theory as affording a more feasible explanation.

do

FRUIT enters largely into the dietary of Americans, and this wholesome practice has been encouraged by the United States Department of Agriculture by means of bulletins indicating the nutritive value of fruit to the consumer and the economic value as a crop to the farmer. A Farmer's Bulletin, No. 293, compiled by Mr. C. T. Langworthy, provides a rational summary of available data on the composition, food value, and place of fruit in the human diet.

do

A CATALOGUE of the plants of New Zealand, similar to the London catalogue of the British Isles, has been prepared by Mr. T. F. Cheeseman for the Education Department of that dominion. The arrangement is that of the author's recently issued "Manual of the New Zealand Flora"; the indigenous and naturalised plants are grouped separately, and the distribution is broadly indicated.

do

IN the Journal of the Royal Society of New South Wales (vol. xl.), Mr. R. H. Mathews gives some details of the organisation of the Kurnu tribe in the north-west of New South Wales, of their rules as to sharing food of the organisation of the Chauan tribe near the north-east border of Western Australia, and of the languages of tribes about Alice Springs; he also gives a Noritcha vocabulary and some details as to avenging parties in Victoria. We learn more as to the "blood" divisions of the Kurnu, of which Mr. Mathews was the discoverer; but an actual genealogy of a small tribe thus organised would be of far more value than many explanations, provided totems, phratries, classes, bloods, and shades were duly noted. It might also enable us to discover whether the present irregularity in marriage regulations is of old standing. The class system of the Chauan tribe seems to be aberrant, so far as the form of the names goes; only two show any close relation to those prevailing among the more easterly eight class tribes; the names are arranged by Mr. Mathews on the supposition that matrilineal descent prevails, but this assumption can only be substantiated by the discovery of phratry names for the two groups of class names, and all the phratry names so far recorded indicate that patrilineal descent is the rule in the north. Mr. Mathews has also published a paper on the Australian tribe in the *Zeitschrift für Ethnologie*, 1906, pp. 939–946. His contributions are now so numerous that he would do well to attempt a general review of the facts he has published, which are otherwise not easy to piece together. It is clear from a paper by Mr. Mathews in vol. xxxvii. of the *Mitteilungen* of the Vienna Anthropological Society that he hardly realises the importance of exhaustiveness or of the localisation of his facts; to take one example, the paper professes to deal with Australian ethnography; the shields described are those of south-east Australia, but there is not a hint that the statements are not true of the whole of the continent.

N. W. Thomas

THE great accuracy which has been attained in the measurement of electric current by the current balance at the National Physical Laboratory will in all probability lead to a more extended use of balances depending on the attraction of co-axial solenoids. A valuable series of papers by E. B. Rosa and L. Cohen dealing with the

C. H. Lees

mutual inductance, and therefore attraction, of such circuits, has appeared in the May Bulletin of the Bureau of Standards at Washington. In one of these the various expressions which have been given for the mutual inductance of co-axial solenoids, from that due to Maxwell to the one Mr. A. Russell gave in the April number of the *Philosophical Magazine*, are compared and tested. Unfortunately, none of them appears to be at the same time accurate and easy of numerical calculation, while in one or two of them the authors have detected small errors.

PUBLICATION No. 62 of the Carnegie Institution of Washington consists of an account by Prof. Carl Barus of the work he has done on the condensation of vapour as induced by nuclei and ions. The condensation is effected in a cylindrical glass fog chamber 6 inches in diameter and 18 inches long, by exhaustion into a vacuum chamber through a stop-cock 4 inches in diameter. The coronas produced in transmitted light by the fog are observed through a goniometer. Different gases have been tried as well as different saturating vapours. In all cases there appear to be three types of condensation nuclei, dust particles, transient bodies which when charged are the ions, and lastly, excessively minute and persistent "colloidal" nuclei, on which condensation only takes place at the higher exhaustions. Prof. Barus has not found any daily period in the number of colloidal nuclei present in the atmosphere which could be ascribed to cosmical radiation. In this respect they differ from the ions, which have been shown by Messrs. A. Wood and A. R. Campbell (NATURE, vol. lxxiii., p. 583) to be present to the maximum extent about 9 a.m. and noon, and to reach a minimum about 3 p.m.

DR. E. GRIMSEHL describes in the *Physikalische Zeitschrift* for July 15 a simple apparatus suitable for demonstrating the principal properties of electric oscillations. Condensers of various sizes are formed by placing two sheets of tinfoil between three sheets of ebonite and vulcanising the whole together, leaving metal ears projecting so that each condenser can be hung on two bare wires which form part of the circuit. Variable inductances are made of solenoids of hard copper wire, one end of each being fixed and the other attached to a slide which can move parallel to the axis of the solenoid, so as to vary the length. The spark gap is formed by two aluminium spheres at the ends of two brass screws which pass through opposite sides of an ebonite box. With this apparatus and, for waves in wires, a simple Hertz generator capable of being tuned, almost all the fundamental experiments on electric oscillations can be performed.

THE curious differences of colour exhibited by the thin films of gold produced on the surface of a glass plate near which a gold wire is slowly disintegrating owing to the passage of an electric current through it, have been explained by M. L. Houllevigue in a communication to the Société Française de Physique at the last meeting (July 15). Films which appear blue in transmitted light are composed of a hydride of gold, stable at ordinary temperatures, but unstable above 130° C., when it loses 7 per cent. to 8 per cent. of its weight. Such a film when heated is converted into the more commonly known form, which appears to be identical with beaten gold leaf, and is green in transmitted light. Several other properties of these films find a simple explanation in M. Houllevigue's discovery.

THE Board of Agriculture has issued the ninth part of the memoir descriptive of the South Wales coalfield (Memoirs of the Geological Survey, price 8*d*.). The volume covers fifty pages, and is an explanation of the new series map, sheet 246, which includes West Gower and the country around Pembrey. The report has been drawn up by Dr. A. Strahan, F.R.S., in part from notes by Messrs. B. S. N. Wilkinson, T. C. Cantrill, and E. E. L. Dixon. The dominant feature in the structure of the district is the anticline which throws up the Old Red Sandstone to form Cefn-y-Bryn. The Old Red Sandstone appears under an aspect that was quite unexpected. The red marls that form the lower half of the formation around most of the coalfield are absent in parts of Gower, whilst the conglomerates at the top attain a remarkable development, and Silurian rocks come to the surface as an inlier. The Carboniferous Limestone is well developed. On the coast between Llanelly and Pembrey, the lower part only of the Pennant series is exposed, but the whole of the Lower Coal series probably exists under the estuary of the Loughor. The probable effect of various anticlines and synclines upon the extent of the Coal-measures under that estuary is taken into consideration and illustrated in a map. The only coal seams hitherto worked are those which are developed in the Pennant series in the western part of the South Wales coalfield, and the value of the concealed and unproved coalfield is lessened by the fact that the strata are likely to be highly inclined and much disturbed. The superficial deposits include the Raised Beach, which is so finely exhibited in East Gower, and glacial deposits, both presenting features of great interest.

WE have received the eleventh of a series of bulletins published by the Engineering Experiment Station of the University of Illinois. It deals with the effect of scale on the transmission of heat through locomotive boiler tubes, and has been drawn up by Prof. E. C. Schmidt and Mr. J. M. Snodgrass. Of late years there has been much discussion on the subject, and statements as to the extent to which deposits of scale affect the conductivity of a tube or sheet have been made from time to time, and have differed widely. The results of the authors' tests lead to the following conclusions:—Considering scale of ordinary thickness, say of thicknesses varying up to $\frac{1}{8}$ inch, the loss in heat transmission due to scale may vary in individual cases from insignificant amounts to as much as 10 per cent. or 12 per cent. The loss increases somewhat with the thickness of the scale. The mechanical structure of the scale is of importance equal to or greater than the thickness in producing this loss. Chemical composition, except in so far as it affects the structure of the scale, has no direct influence on its heat-transmitting qualities.

WE have received from Mr. R. Lavachery, a Belgian engineer residing at Chapultepec, Mexico, drawings of an ingenious appliance invented by him for life-saving at sea. It consists of a rifled cannon from which a projectile is fired; to the projectile are attached a cable, an anchor, and a rocket. The mechanism is very simple, and for humanitarian reasons the inventor has not patented it.

BENJAMIN ROBINS, F.R.S., is remembered as the inventor of the ballistic pendulum and as the founder of the modern science of gunnery. As the details of his life and work are not generally known, opportunity is taken by *Engineering* (July 19), in the year of the 200th anniversary of his birth, to give detailed particulars of his career. Though he only lived to the age of forty-four, yet in that time Robins was in turn mathematical tutor, civil engineer, scientific experimenter, political pamphleteer, editor of "Anson's Voyages," and, at last, engineer-in-chief to the

East India Company. He was among the foremost mathematicians of his day, and had his life been prolonged he would undoubtedly have risen to greater fame.

No. 76 of the Publications of the Carnegie Institution contains an account of a series of researches by Prof. Theodore W. Richards, in conjunction with Messrs. W. N. Stull, F. W. Brink, and F. Bonnet, on the compressibility of a large number of the elements. A very ingenious apparatus was devised for making the measurements, and the results obtained show that the compressibility of an element is a periodic function of the atomic weight, and probably associated with the same causes which determine atomic volume and volatility.

The July number of the *Journal of Hygiene* (vii., No. 3) is devoted to reports on plague investigation in India. Further experimental evidence is detailed of the transference of plague through the intermediary of the flea. It is shown that close and continuous contact of plague-infected animals with healthy animals, if fleas are excluded, does not give rise to an epizootic among the latter, and that when fleas are present the epizootic, if it does start, varies in severity and rate of progress according to the season of the year and the number of fleas present. The season in which epizootics were readily produced experimentally, and spread rapidly, corresponds with that of the plague epidemic.

A second edition of vol. iii. of the "Descriptive and Illustrated Catalogue of the Physiological Series of Comparative Anatomy contained in the Museum of the Royal College of Surgeons of England" has been published. The volume is sold by Messrs. Taylor and Francis. It contains descriptions of the specimens in the section comprising the nerves of vertebrates not dealt with in vol. ii., and also those in the section including the organs of special sense.

The eleventh edition, revised, of Mr. W. T. Lynn's "Celestial Motions" has just been published by Messrs. Samuel Bagster and Sons, Ltd. The price of this handy little book of astronomy is 2s. net.

An interesting article, by Mr. E. V. Heward, upon the physical features of Mars, with particular reference to the habitability of the planet, appears in the August number of the *Fortnightly Review*.

OUR ASTRONOMICAL COLUMN.

Astronomical Occurrences in August:—

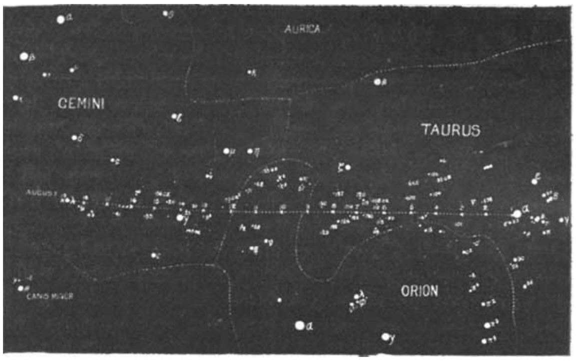
Aug. 1. 4h. Venus and Jupiter in conjunction. Venus 0° 18′ N.
,, Daniel's comet very near Aldebaran.
2. 12h. 8m. Central transit of Saturn's Satellite Titan.
4. 12h. Vesta in conjunction with the Moon. Vesta 0° 52′ S.
,, 15h. 38m. to 16h. 20m. Occultation of χ^1 Orionis (mag. 4·7).
,, Juno very closely S. of ϕ Virginis (mag. 4·9).
10. 14h. Mercury and Jupiter in conjunction. Mercury 2° 6′ S.
10–13. Epoch of August shooting stars, Radiant 45° + 57°.
11. Uranus 1° S. of 28 Sagittarii (mag. 5·6).
14. Daniel's comet near γ Geminorum.
17. 16h. 53m. to 20h. 26m. Transit of Jupiter's Sat. III. (Ganymede).
18. 9h. 51m. Central transit of Saturn's Satellite Titan.
20. 12h. 42m. Minimum of Algol (β Persei).
23. 9h. 31m. Minimum of Algol (β Persei).

Daniel's Comet (1907*d*).—Herr Kritzinger's ephemeris for comet 1907*d* is extended to August 19 in No. 4191 (p. 259, July 23) of the *Astronomische Nachrichten*, and a part of it is given below:—

Ephemeris 12h. (M.T. Berlin).

1907	α (true) h. m.	δ (true) ° ′	log r	log Δ	Brightness
Aug. 3	4 50·1	+16 37·5	9·9453	9·8812	13·8
,, 5	5 8·9	+16 57·8			
,, 7	5 27·8	+17 12·0	9·9116	9·8878	15·6
,, 9	5 46·5	+17 20·0			
,, 11	6 4·8	+17 22·0	9·8763	9·9021	17·2
,, 13	6 22·8	+17 18·3			
,, 15	6 40·3	+17 9·3	9·8399	9·9234	18·5
,, 17	6 57·3	+16 55·6			
,, 19	7 13·6	+16 38·0	9·8036	9·9499	19·3

An observation made on July 19 gave corrections of +4s. and +1′·9 to the ephemeris, and on that date the magnitude of the whole comet was recorded as 4·0.



Apparent path of Daniel's Comet (1907*d*). August 1–19, 1907.

From the accompanying chart it will be seen that during the period August 1–19 the comet's apparent path lies between α Tauri and λ Geminorum, its declination varying but by a small amount. On the former date the comet will rise about four hours, and on the latter about three hours, before sunrise.

The Heliomicrometer.—For the purpose of determining the heliographic positions of flocculi on spectroheliograms, quickly and accurately, Prof. Hale has devised an apparatus which he calls the heliomicrometer, and of which he gives a preliminary description in No. 5, vol. xxv., of the *Astrophysical Journal* (p. 293, June).

Briefly, it is a modification of an earlier instrument in which the spectroheliogram was projected on to a bright globe divided by meridians of latitude and longitude, the positions of the flocculi being read off directly from the globe. The angular diameter of the latter as seen from the projecting lens was, essentially, equal to the angular diameter of the sun as seen from the earth.

In the present apparatus, images of the photograph and the globe are viewed with two similar telescopes, the two images being brought into the same eye-piece. Immediately in front of the plate to be measured cross-hairs are mounted, and their intersection may be set on the particular flocculus to be measured by the observer operating from the eye-piece; during this process the bright image of the globe is occulted. The image of the properly adjusted globe is then admitted, and, by means of fine motions—again operated from the eye-piece—the intersection of the central meridian and the equator is brought into coincidence with the intersection of the cross-hairs. The amount that the globe has been rotated in each coordinate is then read off from circles fitted with verniers, and thus the latitude and longitude of the flocculus are obtained directly without any computation.

In testing the heliomicrometer method against that of